

CLAIMS

What is claimed is:

1. A method for executing an obfuscated application program, the method comprising:
 - receiving an application program that comprises application program instructions and application program data;
 - determining an application program instruction location permutation to apply to a current instruction counter value;
 - determining an application program data location permutation to apply to a current data location counter value;
 - receiving said current instruction counter value;
 - applying said application program instruction location permutation to said current instruction counter value to obtain a first reference to an application program instruction in an instruction stream to execute;
 - if said application program instruction references application program data, applying said application program data location permutation to data referenced by said application program instruction to obtain a second reference to data to access, said data to access interleaved with application program instructions in said instruction stream; and
 - executing said application program instruction.

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2. The method of claim 1 wherein said application program data comprises at least one cryptographic key for use in decrypting data.
3. The method of claim 1 wherein at least some of said data to access is formatted to appear like one or more valid instructions.
4. The method of claim 1 wherein at least some of said data to access comprises randomized data.
5. The method of claim 4 wherein said randomized data is formatted to appear like one or more valid instructions.
6. The method of claim 1, further comprising:
determining whether there is another application program instruction to be executed;
advancing said current instruction counter if there is another application program instruction to be executed; and
repeating said receiving, said applying and said executing after said advancing.
7. A method for application program obfuscation, the method comprising:
reading a first application program comprising application program instructions and application program data;

determining an application program instruction location permutation that transforms said first application program into an obfuscated application program, said obfuscated application program having at least one application program instruction stored at a memory location that is based at least in part on a permutation of the memory location where the corresponding application program instruction is stored in said first application program;

determining a first instruction location of said first application program;

determining an application program data location permutation that transforms said first application program into an obfuscated application program, said obfuscated application program having at least one application program datum stored at a memory location that is based at least in part on a permutation of the memory location where the corresponding application program datum is stored in said first application program;

determining a first data location of said first application program;

applying said application program instruction location permutation and said application program data location permutation to said first application program to create an obfuscated application program comprising an instruction stream having application program data interspersed with application program instructions; and

sending said obfuscated application program.

8. The method of claim 7 wherein said application program data comprises at least one cryptographic key for use in decrypting data.

9. The method of claim 7 wherein at least some of said data to access is formatted to appear like one or more valid instructions.
10. The method of claim 7 wherein at least some of said data to access comprises randomized data.
11. The method of claim 10 wherein said randomized data is formatted to appear like one or more valid instructions.
12. The method of claim 7, further comprising receiving an application program request from a user device, said determining occurring in response to said receiving.
13. The method of claim 7 wherein
said method further comprises, after said applying said application program instruction location permutation and said application program data location permutation, applying a cryptographic process to said obfuscated application program together with a cryptographic key to create an encrypted obfuscated application program; and
said sending comprises sending said encrypted obfuscated application program.

14. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for executing an obfuscated application program, the method comprising:
- receiving an application program that comprises application program instructions and application program data;
 - determining an application program instruction location permutation to apply to a current instruction counter value;
 - determining an application program data location permutation to apply to a current data location counter value;
 - receiving said current instruction counter value;
 - applying said application program instruction location permutation to said current instruction counter value to obtain a first reference to an application program instruction in an instruction stream to execute;
 - if said application program instruction references application program data, applying said application program data location permutation to data referenced by said application program instruction to obtain a second reference to data to access, said data to access interleaved with application program instructions in said instruction stream; and
 - executing said application program instruction.
15. The program storage device of claim 14 wherein said application program data comprises at least one cryptographic key for use in decrypting data.

16. The program storage device of claim 14 wherein at least some of said data to access is formatted to appear like one or more valid instructions.
17. The program storage device of claim 14 wherein at least some of said data to access comprises randomized data.
18. The program storage device of claim 17 wherein said randomized data is formatted to appear like one or more valid instructions.
19. The program storage device of claim 14, said method further comprising:
determining whether there is another application program instruction to be executed;
advancing said current instruction counter if there is another application program instruction to be executed; and
repeating said receiving, said applying and said executing after said advancing.
20. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for application program obfuscation, the method comprising:
reading a first application program comprising application program instructions and application program data;

determining an application program instruction location permutation that transforms said first application program into an obfuscated application program, said obfuscated application program having at least one application program instruction stored at a memory location that is based at least in part on a permutation of the memory location where the corresponding application program instruction is stored in said first application program;

determining a first instruction location of said first application program;

determining an application program data location permutation that transforms said first application program into an obfuscated application program, said obfuscated application program having at least one application program datum stored at a memory location that is based at least in part on a permutation of the memory location where the corresponding application program datum is stored in said first application program;

determining a first data location of said first application program;

applying said application program instruction location permutation and said application program data location permutation to said first application program to create an obfuscated application program comprising an instruction stream having application program data interspersed with application program instructions; and

sending said obfuscated application program.

21. The program storage device of claim 20 wherein said application program data comprises at least one cryptographic key for use in decrypting data.

22. The program storage device of claim 20 wherein at least some of said data to access is formatted to appear like one or more valid instructions.

23. The program storage device of claim 20 wherein at least some of said data to access comprises randomized data.

24. The program storage device of claim 23 wherein said randomized data is formatted to appear like one or more valid instructions.

25. The method of claim 14, said method further comprising receiving an application program request from a user device, said determining occurring in response to said receiving.

26. The program storage device of claim 14 wherein said method further comprises, after said applying said application program instruction location permutation and said application program data location permutation, applying a cryptographic process to said obfuscated application program together with a cryptographic key to create an encrypted obfuscated application program; and said sending comprises sending said encrypted obfuscated application program.

27. An apparatus for executing an obfuscated application program, the apparatus comprising:
means for receiving an application program that comprises application program instructions and application program data;

means for determining an application program instruction location permutation to apply to a current instruction counter value;

means for determining an application program data location permutation to apply to a current data location counter value;

means for receiving said current instruction counter value;

means for applying said application program instruction location permutation to said current instruction counter value to obtain a first reference to an application program instruction in an instruction stream to execute;

means for if said application program instruction references application program data, applying said application program data location permutation to data referenced by said application program instruction to obtain a second reference to data to access, said data to access interleaved with application program instructions in said instruction stream;

and

means for executing said application program instruction.

28. The apparatus of claim 27 wherein said application program data comprises at least one cryptographic key for use in decrypting data.

29. The apparatus of claim 27 wherein at least some of said data to access is formatted to appear like one or more valid instructions.

30. The apparatus of claim 27 wherein at least some of said data to access comprises randomized data.

31. The apparatus of claim 30 wherein said randomized data is formatted to appear like one or more valid instructions.

32. The apparatus of claim 27, further comprising:

means for determining whether there is another application program instruction to be executed;

means for advancing said current instruction counter if there is another application program instruction to be executed; and

means for repeating said receiving, said applying and said executing after said advancing.

33. An apparatus for application program obfuscation, the apparatus comprising:

means for reading a first application program comprising application program instructions and application program data;

means for determining an application program instruction location permutation that

transforms said first application program into an obfuscated application program, said

obfuscated application program having at least one application program instruction

stored at a memory location that is based at least in part on a permutation of the memory

location where the corresponding application program instruction is stored in said first

application program;

means for determining a first instruction location of said first application program;

means for determining an application program data location permutation that transforms said first application program into an obfuscated application program, said obfuscated application program having at least one application program datum stored at a memory location that is based at least in part on a permutation of the memory location where the corresponding application program datum is stored in said first application program;

means for determining a first data location of said first application program;

means for applying said application program instruction location permutation and said application program data location permutation to said first application program to create an obfuscated application program comprising an instruction stream having application program data interspersed with application program instructions; and

means for sending said obfuscated application program.

34. The apparatus of claim 33 wherein said application program data comprises at least one cryptographic key for use in decrypting data.
35. The apparatus of claim 33 wherein at least some of said data to access is formatted to appear like one or more valid instructions.
36. The apparatus of claim 33 wherein at least some of said data to access comprises randomized data.

37. The apparatus of claim 36 wherein said randomized data is formatted to appear like one or more valid instructions.

38. The apparatus of claim 33, said apparatus further configured to receive an application program request from a user device, said determining occurring in response to said receiving.

39. The apparatus of claim 33 wherein

said apparatus further comprises, after said applying said application program instruction location permutation and said application program data location permutation, means for applying a cryptographic process to said obfuscated application program together with a cryptographic key to create an encrypted obfuscated application program; and said means for sending comprises means for sending said encrypted obfuscated application program.

40. An apparatus for executing an obfuscated application program, the apparatus comprising a user device configured to:

receive an application program that comprises application program instructions and application program data;

determine an application program instruction location permutation to apply to a current instruction counter value;

determine an application program data location permutation to apply to a current data location counter value;

receive said current instruction counter value;

apply said application program instruction location permutation to said current instruction counter value to obtain a first reference to an application program instruction in an instruction stream to execute;

apply said application program data location permutation to data referenced by said application program instruction to obtain a second reference to data to access, said data to access interleaved with application program instructions in said instruction stream;

and

execute said application program instruction.

41. The apparatus of claim 40 wherein said application program data comprises at least one cryptographic key for use in decrypting data.

42. The apparatus of claim 40 wherein at least some of said data to access is formatted to appear like one or more valid instructions.

43. The apparatus of claim 40 wherein at least some of said data to access comprises randomized data.

44. The apparatus of claim 43 wherein said randomized data is formatted to appear like one or more valid instructions.

45. The apparatus of claim 40, said user device further configured to:

determine whether there is another application program instruction to be executed;
advance said current instruction counter if there is another application program instruction to be executed; and
repeat said receiving, said applying and said executing after said advancing.

46. An apparatus for application program obfuscation, the apparatus comprising an application program provider configured to:

read a first application program comprising application program instructions and application program data;
determine an application program instruction location permutation that transforms said first application program into an obfuscated application program, said obfuscated application program having at least one application program instruction stored at a memory location that is based at least in part on a permutation of the memory location where the corresponding application program instruction is stored in said first application program;
determine a first instruction location of said first application program;
determine an application program data location permutation that transforms said first application program into an obfuscated application program, said obfuscated application program having at least one application program datum stored at a memory location that is based at least in part on a permutation of the memory location where the corresponding application program datum is stored in said first application program;
determine a first data location of said first application program;

if said application program instruction references application program data, apply said application program instruction location permutation and said application program data location permutation to said first application program to create an obfuscated application program comprising an instruction stream having application program data interspersed with application program instructions; and
send said obfuscated application program.

47. The apparatus of claim 46 wherein said application program data comprises at least one cryptographic key for use in decrypting data.
48. The apparatus of claim 46 wherein at least some of said data to access is formatted to appear like one or more valid instructions.
49. The apparatus of claim 46 wherein at least some of said data to access comprises randomized data.
50. The apparatus of claim 49 wherein said randomized data is formatted to appear like one or more valid instructions.

51. The apparatus of claim 46, said application program provider further configured to receive an application program request from a user device, said determining occurring in response to said receiving.

52. The apparatus of claim 46 wherein

said application program provider is further configured to, after said applying said application program instruction location permutation and said application program data location permutation, apply a cryptographic process to said obfuscated application program together with a cryptographic key to create an encrypted obfuscated application program; and

said application program provider is further configured to send said encrypted obfuscated application program.